National Aeronautics and Space Administration

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Pegasus XL–HESSI: Last-Minute Decisions in Flight-Based Launch

Scheduled for a drop launch between 3:26 and 5:21 p.m. EDT, *Pegasus XL–HESSI* officially launched at 3:58 p.m.. It was the first and only *Pegasus* to execute a "recycle" (rather than aborting) and launch on the second pass. According to NASA Launch Manager (NLM) Chuck Dovale:

> We were battling three main issues: spotty communications, cold equipment temperatures, because we were in captive carry so long, and time—a rapidly narrowing launch window. On the initial attempt, we had bad communications heading to the launch point. The communications between the launch conductor on the ground and the pilot on the aircraft were dropping in and out quite a bit.
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> It's an interesting dilemma, because we do expect some "comm" outages as the aircraft turns, while flying the "racetrack." Usually comm works fine on the final approach to the launch point—this time it didn't. This was the first launch at Kennedy for this configuration, which may have contributed to the problem.
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> Furthermore, it wasn't clear if we would violate the minimum temperature constraint on some of the electronics. The current decreasing trend was showing that we would be within specs. But, trends change—it's a guess: "At X point, we'll be at X temperature?" We have to estimate. We knew that we had a potential second chance that we could have deferred to, but we also knew that we were definitely going to violate the launch constraint on that attempt, and a waiver would be required.

Dovale said that the launch constraint was not "mandatory." He explained that there is a launch constraint hierarchy consisting of "mandatory," "required," and "desired." If the temperature constraint had been mandatory, they would have had no choice but to scrub the launch. Because it was a "required"

constraint, Dovale and his team had some flexibility to waive it with the proper rationale. However, at L–4, all "required" constraints become "mandatory."

Ultimately, while the team was working the temperature issue, the poor communications forced the launch conductor to abort the first attempt at T–2:40. The timeline of events between the ground and the aircraft were not in sync, when communications were re-established at T–2:40.

This dilemma forced Dovale to engage his team in a quick discussion, before making a launch decision for a second attempt. With the temperature launch constraint set at –25° C (Celsius) and the temperature falling, Dovale and his engineers considered the fact that the design passed acceptance testing to a temperature of –36° C. According to Dovale:

> It wasn't a cut-and-dried technical decision. It took management discussion of the risk at hand. It definitely had an element of a "gut" decision—it wasn't a black and white option. But, it was a good decision because we had that discussion with the entire community. We *were* violating a [temperature] launch constraint, but we looked at the [*Pegasus's*] design capabilities. We had to decide if there was enough margin—enough for us to feel comfortable with a go decision. It wasn't the first time we had to face this with *Pegasus's* temperatures and the captive-carry portion of flight; we address this issue from time to time. It was a tight call, but there were no dissenting opinions.

Asked whether it would have still been a "good" decision if they had launched and it had failed, Dovale said:

> The decision process holds up under scrutiny. The rationale was sound, the system robust, and with no dissenting opinions, the team was ready. It was unanimous: engineering and management, contractor and government. It was a rare opportunity for a second attempt. I asked engineering about their comfort level, and the history of the system was investigated quickly. It was a good decision, and ultimately, a good launch.[1]

Two months after the launch, the spacecraft was rechristened *RHESSI*—the *Reuven Ramaty High Energy Solar Spectroscopic Imager*—in honor of the late NASA scientist who pioneered the fields of solar-flare physics, gamma-ray astronomy, and cosmic-ray research. Ramaty died in 2001 of Lou Gehrig's disease after a long and distinguished career in the Laboratory for High Energy Astrophysics at Goddard Space Flight Center, in Greenbelt, Maryland.

In 2006, the NASA Senior Review Panel found that *RHESSI's* "future contributions promise to be compelling" and rated its science merit second only to that of *Voyager* among the 13 operating Sun-Solar System Connection (SSSC, now Heliophysics Division) missions. *RHESSI* was rated number one in its "Contribution to SSSC Goals."

[1] A video of the launch is available at: http://science.ksc.nasa.gov/payload/missions/hessi/.